

**Warm up****Convert to a Mixed Radical**

a)  $\sqrt{48}$

$$\begin{array}{l} 1 \times 48 \\ 2 \times 24 \\ 3 \times 16 \end{array}$$

$$\begin{array}{l} \sqrt{16 \times 3} \\ \sqrt{16} \times \sqrt{3} \\ 4\sqrt{3} \end{array}$$

b)  $\sqrt{68}$

$$\begin{array}{l} 1 \times 68 \\ 2 \times 34 \\ 4 \times 17 \end{array}$$

$$\begin{array}{l} \sqrt{4 \times 17} \\ \sqrt{4} \times \sqrt{17} \\ 2\sqrt{17} \end{array}$$

c)  $\sqrt{180}$

$$\begin{array}{l} 1 \times 180 \\ 2 \times 90 \\ 3 \times 60 \\ 4 \times 45 \\ 5 \times 36 \end{array}$$

$$\begin{array}{l} \sqrt{36 \times 5} \\ \sqrt{36} \times \sqrt{5} \\ 6\sqrt{5} \end{array}$$



# Operations with Radicals

## Lesson objectives

- I know how to add and subtract radicals (simplify)
- I know how to multiply radicals
- I know how to multiply radicals that are expressed like binomials

1.1

Lesson objectives

Teachers' notes

Lesson notes

Nelson Page 167 #s 2, 3 & 5 - 7 (you can now complete #6 from last time)

## Operations with Radicals - Add/Subtract

Like Radicals: radicals that have the same number under the radical symbol;  $3\sqrt{6}$  and  $-2\sqrt{6}$  are like radicals

### Adding and Subtracting

- Like with polynomials, when we add like radicals we add the coefficients and keep the radicals the same.

$$-2\sqrt{6} + 4\sqrt{6} = 2\sqrt{6}$$

- If we don't have like radicals we might need to simplify the radical first - otherwise they can't be added or subtracted.

### Example

a)  $\sqrt{12} + \sqrt{75}$

$$\begin{array}{l} 1 \times 12 \\ 2 \times 6 \\ 3 \times 4 \\ \hline \sqrt{4 \times 3} \\ \sqrt{4} \times \sqrt{3} \\ 2\sqrt{3} + 5\sqrt{3} \\ = 7\sqrt{3} \end{array} \quad \begin{array}{l} 1 \times 75 \\ 3 \times 25 \\ \hline \sqrt{25 \times 3} \\ \sqrt{25} \times \sqrt{3} \\ 5\sqrt{3} \end{array}$$

b)  $\sqrt{20} + \sqrt{45}$

$$\begin{array}{l} 1 \times 20 \\ 2 \times 10 \\ 4 \times 5 \\ \hline \sqrt{4 \times 5} \\ \sqrt{4} \times \sqrt{5} \\ 2\sqrt{5} + 3\sqrt{5} \\ = 5\sqrt{5} \end{array} \quad \begin{array}{l} 1 \times 45 \\ 3 \times 15 \\ 5 \times 9 \\ \hline \sqrt{9 \times 5} \\ \sqrt{9} \times \sqrt{5} \\ 3\sqrt{5} \end{array}$$



## Operations with Radicals - Multiplication

When multiplying we need to multiply the coefficients together and multiply the radicals together:

$$3\sqrt{5} \times -2\sqrt{3} = (3)(-2)\sqrt{(5)(3)} = -6\sqrt{15}$$

We can also multiply radicals like we do binomials, if there are two terms.

$$(3\sqrt{2} + 1)(4\sqrt{3} - 2)$$

	$4\sqrt{3}$	$-2$
$3\sqrt{2}$	$12\sqrt{6}$	$-6\sqrt{2}$
$1$	$4\sqrt{3}$	$-2$

$$= 12\sqrt{6} - 6\sqrt{2} + 4\sqrt{3} - 2$$

### Example

a)  $(3\sqrt{2})(2\sqrt{5})$

$$= (3)(2)(\sqrt{2})(\sqrt{5})$$

$$= 6\sqrt{10}$$

b)  $(3 + \sqrt{2})(2 - \sqrt{3})$

	$3$	$\sqrt{2}$
$2$	$6$	$2\sqrt{2}$
$-\sqrt{3}$	$-3\sqrt{3}$	$-\sqrt{6}$

$$= -\sqrt{6} - 3\sqrt{3} + 2\sqrt{2} + 6$$



**Example**

c)  $(\sqrt{2} + 2\sqrt{3})(2\sqrt{2} - \sqrt{3})$

	$\sqrt{2}$	$2\sqrt{3}$
$2\sqrt{2}$	$2\sqrt{4}$	$4\sqrt{6}$
$-\sqrt{3}$	$-\sqrt{6}$	$-2\sqrt{9}$

$$= 2\sqrt{4} + 4\sqrt{6} - \sqrt{6} - 2\sqrt{9}$$

$$= (2)(2) + 3\sqrt{6} - (2)(3)$$

$$= 4 + 3\sqrt{6} - 6 \Rightarrow 3\sqrt{6} - 2$$

